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AN EXCEPTIONAL FOSSIL AMBER COLLECTION ACQUIRED BY THE SMITHSONIAN INSTITUTION

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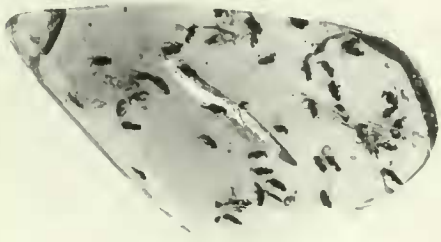
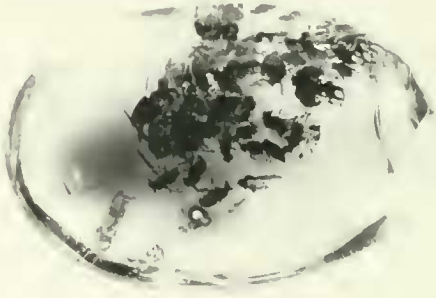
Abstract.—One of the largest collections of fossil arthropods preserved in amber from the Dominican Republic has been acquired by the Smithsonian Institution's Department of Entomology. The collection, known as the Brodzinsky/Lopez-Penha Collection, comprises over 5000 amber samples estimated between 20 and 30 million years old. Each sample contains from 1 to over 65 specimens of arthropods representing 22 insect orders as well as several arachnids and myriapods and some plant material.

Key Words: amber, fossil insects, fossil arthropods

The Department of Entomology of the National Museum of Natural History, with the support of the Smithsonian Institution's Collection Acquisition Program, has recently acquired one of the largest collections of fossil organisms in Dominican amber. The collection was amassed by Jacob Brodzinsky and Marianela Lopez-Penha Brodzinsky of Santo Domingo, Dominican Republic. The Brodzinsky/Lopez-Penha Collection comprises over 5000 amber samples, with each piece containing from one to approximately 65 fossilized organisms (Figs. 3, 4). Although a tally has not been completed, a conservative estimate would place the number of insect inclusions in this collection at well over 10,000.

For several millennia humans have been fascinated by amber, not only by its beauty but also for its use in amulets and medicines. Its formation is still only partially understood, although its general properties are well known. Amber is a fossilized, highly polymerized resin and, consequently, of vegetable origin. It requires millions of years to form, and exposure to the catalytic action of salt water probably is needed to harden and polymerize it. It has a hardness varying between 1 and 3, a specific gravity between 1 and 1.3, and a melting point ranging from 120°C to 400°C (usually 300°C to 400°C for Dominican amber). These characteristics distinguish amber from the more recent copals and most of the plastic imitations (Larsson 1978, Poinar 1985). Amber is not a stable substance but, instead, can gradually oxidize, dry out, and crack once removed from its natural ground or seabed deposit and polished. Consequently, one of the clues to preservation is storing the samples in containers with minimal exposure to air but, as is true for pearls, with occasional handling to provide a protective oil film. Dominican amber is frequently clear and honey colored although it can range in color from nearly transparent to jet black through yellow, red, blue, and green (Baroni-Urbani and Saunders 1980). Amber deposits around the world vary greatly in age, in degree of fossilization, as well as in plant origin. In the Dominican Republic this material is found as secondary deposits in mid-Tertiary sandstone marine silts which range between 20 to 30 million years in age. The





Figs. 1–5. Brodzinsky/Lopez-Penha Amber Collection. 1, Standard USNM drawer with trays containing individual samples. 2, Detail of sample tray showing label data and samples enclosed in zip-lock plastic bags. 3, Sample 10747, containing approximately 50 specimens of mostly Dolichopodidae (4 mm). 4, Sample 10755, containing approximately 65 specimens of Dolichopodidae (4 mm). 5, Sample containing a flower petal from the tree (*Hymenaea*) and probable source of the original resin, and a mycetophilid fly. (Scale length in parentheses.)

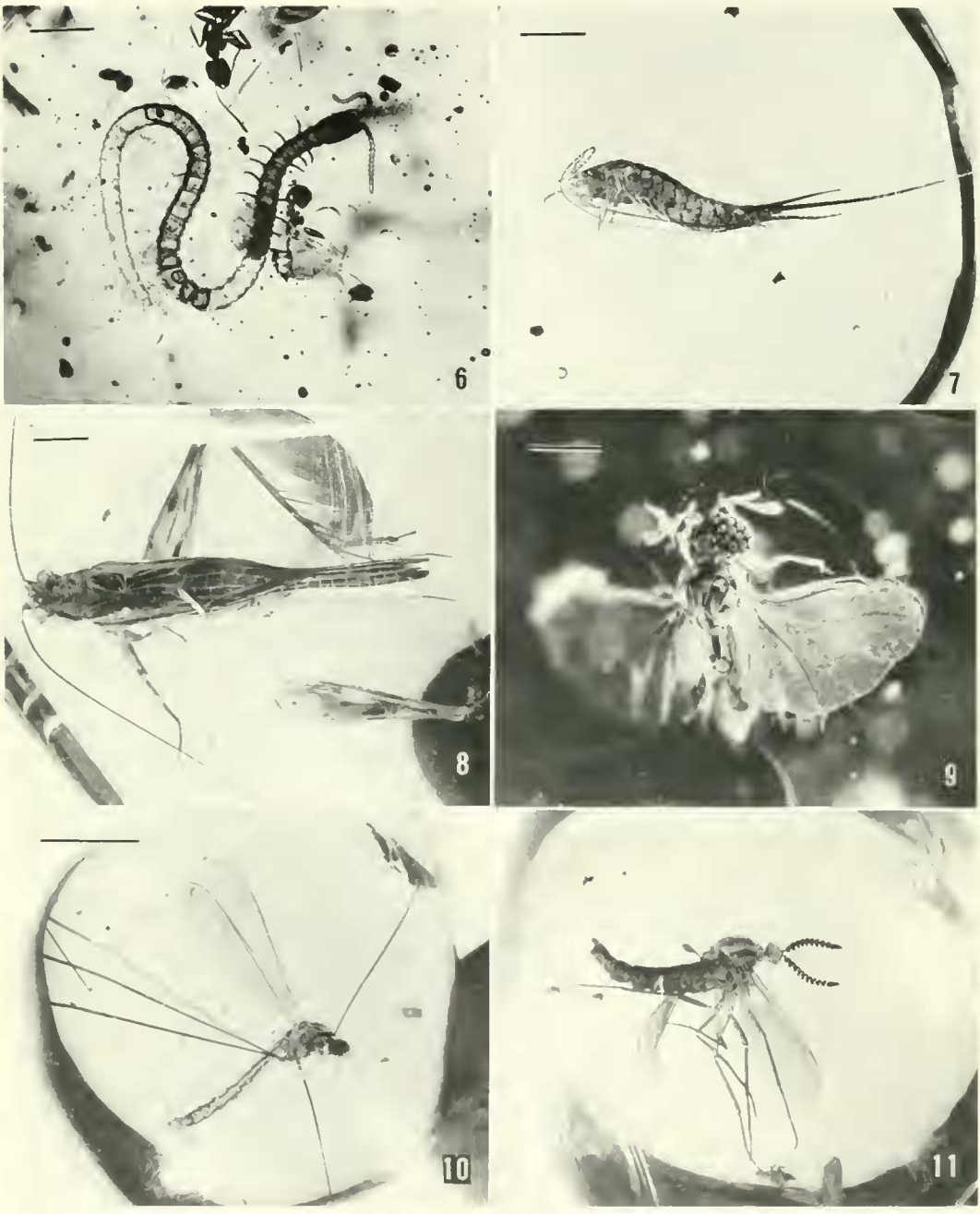
primary plant source of Dominican amber is believed to be *Hymenaea*, an extant genus of Leguminosae currently represented by one African species and about two dozen neotropical species (Poinar 1985).

The scientific value of amber lies primarily in the inclusions it often contains; frequently these inclusions are insects. The preservation of some specimens, in which the object itself is often intact and is not merely represented by an impression or some mineral replacement, can be so perfect to appear unreal considering their antiquity.This has prompted some scientists to liken such samples as "windows to the past." The natural fixatives in some plant resins have preserved tissues so well that sectioning has revealed such minute anatomical details as nuclei and other cellular inclusions (Poinar and Hess 1982).

Amber from the Dominican Republic was first reported by Christopher Columbus after his second voyage between September 1492 and March 1496 (Hale 1891). No further mention of this material has been noted until the early twentieth century. Sanderson and Farr (1960) visited one of the major Dominican deposits and reported on the diverse representation of fossil insects. Schlee and Glöckner (1978) lists 28 arthropod orders represented in Dominican amber in their general review of "Bernstein." Only two years later, this inventory was updated by Baroni-Urbani and Saunders (1980). Thus far the Dominican Republic is the only locality in the West Indies where amber has been found.

My first experience with Dominican amber, other than examining occasional museum samples, occurred during a fieldtrip in 1973. After visiting several amber shops in Santo Domingo, I became duly impressed at the amount of fossil material being sold as jewelry and, for all purposes, lost to science. It was apparent that a major source of knowledge on the Tertiary insect fauna was disappearing without adequate sampling or documentation. Subsequently, I routinely urged every amber dealer I occasionally met to allow interested biologists to examine and perhaps purchase the best preserved fossils before these were sold on the general market. In 1977 I had the good fortune of meeting Mr. Jacob Brodzinsky and his wife, who like so many previous amber dealers, visited our entomology department with the desire to have their fossil insects identified. The Brodzinsky's were not only sympathetic to my plea to allow entomologists to examine their fossil material, but they also began in earnest to amass a sizeable collection of their own. A year later Brodzinsky met Dr. Robert Woodruff of the Florida Department of Agriculture, an entomologist also interested in amber fossils. Together with Brodzinsky, Woodruff began to register this material as a means of permanently documenting the identification and final deposition of the more valuable specimens. This registry has now approached 12,000 samples. A major portion of this material, all collected after 1977 and containing some of the rarest and best preserved fossil specimens, was set aside as the Brodzinsky/Lopez-Penha Collection.

Jacob Brodzinsky has estimated that approximately five percent of the amber samples discovered contain insect remains. This estimate agrees with the overall inclusion percentage others have expressed (Baroni-Urbani and Saunders 1980). Brodzinsky also has reported (in litt.) that on at least two occasions he has encountered between 12 and 20 specimens for each pound of amber examined. The overwhelming majority of these inclusions either represent fragmentary remains or are so poorly positioned that identification, even to the family level, may be impossible. As an example of the culling process that must be accomplished, Brodzinsky estimates that he has examined approximately 140,000 amber samples containing inclusions since 1977. From this considerable material, he selected only the finest examples for his personal collection and the smaller collections which he sold



Figs. 6–11. Brodzinsky/Lopez-Penha Amber Collection. 6, Sample 9366, centipede (Geophilidae?) and Formicidae (1 mm). 7, sample 9452, Archaeognatha (2 mm). 8, sample 8873, Gryllidae, Trigonidiinae, *Annaxipha* sp. (2 mm). 9, Sample 5204, Strepsiptera (0.5 mm). 10, Sample 10939, Tipulidae, *Trentepohlia* sp. (2 mm). 11, Sample 10668, Keroplatidae (Mycetophilidae, sensu latu). (Scale length in parentheses.)

piecemeal to various scientific institutions, including the Smithsonian Institution. A cursory inventory of the Brodzinsky/Lopez-Penha Collection reveals the high degree of his selection and desire to assemble a truly representative sample. Included in the over 5000 samples are 22 of the 26 generally recognized insect orders. The four orders not represented are Protura, Anoplura, Mallophaga, and Mecoptera. Ants are among the most common insects trapped by resin flows and subsequently entombed in amber. Realizing this, Brodinsky did not "load" his collection with this one family (less than 300 samples contain Formicidae), but instead he attempted to diversify the collection as much as possible. Among some of the rarer specimens are: Embioptera (7 examples), Ephemeroptera (9), Neuroptera (6, including one intact Hemerobiidae and one Sialidae), Plecoptera (1), Siphonaptera (1), Strepsiptera (3), Zoraptera (1), and many rare Coleoptera, Diptera, Homoptera, Hymenoptera, Lepidoptera, and Trichoptera. Other rare organisms include preserved flowers (Fig. 5) of the tree (*Hymenaea*) believed to be the primary source of the amber, centipedes (Fig. 6), millipeds, isopods, pseudoscorpions, mites, and one small bird feather. Among the more unusual samples are such specimens as copulating pairs of Diptera (Ceratopogonidae and Chironomidae) and a micropezid fly with a colony of phoretic mites on the ovipositor. George Poinar of the University of California, and one of the appraisers of the collection, has estimated (in litt.) that approximately 20% of the collection consists of new species or potential holotypic material. The absence of some insect groups is also of some interest. Although aphids are relatively common in Baltic amber, none have yet turned up in the large sample examined by Brodzinsky.

The Brodzinsky/Lopez-Penha Collection is now stored in standard insect drawers (Fig. 1) within airtight steel cabinets. Each sample is enclosed within a small zip-locked plastic bag which is then placed in individual trays arranged in numerical sequence according to the Woodruff registry number (Fig. 2). A permanent register number is attached to the tray with a duplicate label included inside the bag with the sample. The fossil contents are currently in the process of being inventoried and recorded in dBase III for rapid access.

Future acquisition and research on Dominican amber could become more difficult. As recently reported (Anonymous 1988) the government of the Dominican Republic has now taken more stringent steps to regulate the export of amber fossils. Decree number 288-87 states that the amber mines are government property under law. Exportation of amber with plant or animal fossils is prohibited unless accompanied by official permission granted by the Museo Nacional de Historia Natural, Santo Domingo.

Jacob and Marianela Brodzinsky are still very much involved with their Dominican amber enterprise. It is hoped they will continue to discover new and exciting fossils and bring these to the attention of interested investigators for some time to come. For their concern of this scientifically priceless heritage, all biologists should be grateful.

Acknowledgments

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